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Benjamin P. Doty, P.E.
Geotechnical and Ground-Water Engineering

1240 Orchard Road
Golden, Colorado 80401
(303) 233-0577

MEMORANDUM

To: T.C. Greengard
From: B.P. Doty
Date: July 21, 1988

1801-03

Subject: Volatile Organics and the 881 Hillside French Drain

As requested, this memo focuses on chemical conditions (organics) in both soils and ground water at and downgradient of the proposed french drain on the 881 Hillside. The memo seeks to address the following question.

Are the organic detections due to field or laboratory contamination or do they represent the leading edge of the plume?

Wells and boreholes downgradient of the drain are listed on Table 1 and the locations are shown on Figure 1. Organic chemical conditions are evaluated at each of the general areas presented on Table 1.

SKIMMING POND AREA

The soil gas samplers generally found non-detectable volatile organic compound ion counts in the areas downgradient of the french drain in the general vicinity of the skimming pond. Boreholes were drilled at the two non-zero tetrachloroethene (PCE) ion counts in the area: BH2-87 near the 305 count and BH6-87 near the 1541 count. In addition, a colluvial well (2-87) and a bedrock well (3-87BR) were drilled as paired wells directly downgradient of the skimming pond.

BH2-87

PCE was not detected in the solid samples from BH2-87; however, several other volatile and semi-volatile compounds were found (Table 2). The two common lab contaminants (methylene chloride and acetone) were found in all five of the samples. Methylene chloride concentrations are relatively uniform with depth (except for the uppermost six feet of bedrock in which methylene chloride is apparently four times higher than elsewhere. Acetone appears to increase with depth through the soils and into the bedrock. The other volatile

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Table 1. Wells and Boreholes downgradient of the 881
Hillside French Drain

<u>Wells</u>	<u>Boreholes</u>	<u>General Areas</u>
2-87 3-87BR	BH2-87 BH3-87 BH6-87	Skimming Pond
69-86 59-86BR 8-87BR		Three Well Cluster
48-87 47-87		Below SWMU 119.1

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Table 2. Volatile and Semi-Volatile Compounds in Solid
Samples from BH2-87

<u>Sample</u>	<u>Depth (ft)</u>	<u>MCl</u>	<u>Ace</u>	<u>2-But</u>	<u>Di</u>	<u>Bis</u>
BH02870012	0.0-11.8	23.1	18.1	10 U	3643	5023
BH02871214	11.8-14.3	34	46.3	10 U	3133	4482
BH028714CT	12.0-14.3	49 B	82 B	75	330 U	2700

Claystone bedrock @ 14.3 feet

BH02871420	14.3-20.4	200 B	100 B	100	43 J	2800
BH028718BR	17.9-18.6	36.2	78.3	10 U	3190	7214

Notes:

Units are micrograms per kilogram.

Compound abbreviations are as follows.

MCl = Methylene Chloride

Ace = Acetone

2-But = 2-Butanone

Di = di-n-Butyl Phthalate

Bis = bis(2-Ethylhexyl)Phthalate

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compound, 2-butanone (methyl ethyl ketone), also appears to increase with depth. The two phthalate compounds are relatively uniform with depth, except that di-n-butyl phthalate is not detected at the bedrock contact.

The detection of these volatile and semi-volatile compounds in the solid samples from BH2-87 is considered to result from contamination in the field and laboratory for the following reasons.

1. Four of the five compounds are the common laboratory contaminants. Although methylene chloride and acetone were not found in all of the blanks associated with these samples, they were associated with two of the five. The phthalates were not found in any of the blanks associated with these samples but phthalates were certainly found in numerous blanks during the 881 RI. Thus, it is our opinion that there is a certain probability that the detected compounds were introduced in the laboratory procedures during sample analysis but not during blank analysis.
2. Acetone and 2-butanone concentrations appear to increase with depth. This is considered highly unlikely given that these compounds are relatively soluble and both are less dense than water (relative densities of 0.792 and 0.8255, respectively).
3. The expected compound (PCE) was not detected in the solid samples.
4. Most convincingly, two of the samples (BH02871214 and BH028714CT) are from essentially the same depth (11.8-14.3 as compared to 12.0-14.3) and the compounds are either not detected or found in the blank in at least one of the samples.

The only compound with even vaguely reproducible results is bis(2-ethylhexyl)phthalate. Bis(2-ethylhexyl)phthalate is ubiquitous in the 881 Hillside RI soil samples. Because it is found in almost every sample, it is concluded that the field procedures (which involved wrapping the samples in saran wrap) probably caused the bis(2-ethylhexyl)phthalate concentrations.

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Based on these considerations, it is concluded that there is not volatile or semi-volatile organic contamination in the vicinity of BH2-87.

BH3-87

Volatiles were found in all four of the samples; however, the detected compounds are common laboratory contaminants and were either at estimated concentrations or were also found in the blank (Table 3). The only exception to this is the detection of 60 ug/kg 2-butanone in the bedrock sample.

The 2-butanone results are rather unusual because (1) the compound is not detected in the soils (as opposed to bedrock) and (2) the compound is not detected in the ground water. If all of the compound found in the bedrock were present as dissolved 2-butanone in the pore water and the saturated porosity were 30 percent by volume, the water would have a 2-butanone concentration of about 700 ug/l in order to produce a solid concentration of 100 ug/kg. This should be easily detectable in the ground-water samples from well 2-87 (built in boring BH3-87); however, 2-butanone has never been detected in the samples from well 2-87. 2-butanone is relatively soluble in water (about 23% by weight) and is less dense than water with a specific gravity of about 0.8 (Sax and Lewis, 1987); thus it is unlikely that 2-butanone is in the bedrock as a separate phase sinking liquid. Therefore, the environmental significance of the 2-butanone detection is questionable and it is concluded that the 2-butanone is laboratory contamination.

The only semi-volatile detected was bis(2-ethylhexyl) phthalate at concentrations ranging from 660 to 940 ug/kg in all four samples. However, bis(2-ethylhexyl)phthalate was also found in the blank at an unknown level. According to EPA (1985), phthalate esters are also common contaminants and sample concentrations should be reported as not detected if they are less than ten (10) times the concentration found in the blank. Assuming that the detection limit in the blank was 150 ug/kg (equal to the single not detected value presented in the RI), then values less than 1500 should be reported as not detected following EPA (1985). Based on these considerations, it is concluded that semi-volatile compounds are not present in the solid samples from BH3-87.

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Table 3. Volatile and Semi-Volatile Compounds in Solid
Samples from BH3-87

<u>Sample</u>	<u>Depth (ft)</u>	<u>MCl</u>	<u>Ace</u>	<u>2-But</u>	<u>Bis</u>
BH3870204	2-4?	2 JB	2 JB	8 JB	NR
BH3870009	0.0-8.75	NR	NR	NR	940 B
BH38702WT	2.45-3.9	24 JB	9 JB	14 JB	700 B
BH38709CT	7.15-8.75	13 J	69 B	10 U	660 B
Sandy claystone bedrock @ 8.75 feet					
BH38712BR	11.75-13.25	8 J	21 JB	60	730 B

Notes:

Units are micrograms per kilogram.

Compound abbreviations are as follows.

MCl = Methylene Chloride

Ace = Acetone

2-But = 2-Butanone

Bis = bis(2-Ethylhexyl)Phthalate

NR = Not Reported in 881 Hillside RI

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BH6-87

The common laboratory contaminants were found in the solid samples from BH6-87 (Table 4). Methylene chloride was found ranging from an estimated concentration of 23 micrograms per kilogram (ug/kg) to 83 ug/kg. Although the compound was not found in the blanks associated with these samples, it is considered very likely that these relatively low concentrations result from laboratory contamination rather than environmental conditions.

Acetone was found in all of the samples at concentrations ranging from 110 to 190 ug/kg but was also found in the associated blanks. Blank data were not reported in the RI, but it can be assumed that the acetone concentrations in the blanks must have been greater than 10 ug/kg (the detection limit for a sample dilution factor of one). This implies that concentrations of 100 ug/kg (and higher) should have been reported as not detected following strict EPA contract laboratory protocol (EPA, 1985). Because the reported concentrations are higher than 100 ug/kg and the blank results are not reported, it cannot be definitively said that the acetone results are probable lab contamination; however, it seems very likely that this is the case.

Bis(2-ethylhexyl)phthalate was found in all samples at concentrations ranging from 510 to 1500 ug/kg; the compound was also found in the associated blanks. Assuming that the detection limit in the blank was 150 ug/kg (equal to the single not detected value reported in the RI), then values less than 1500 should have been reported as not detected.

Based on these considerations, it is concluded that there is not volatile or semi-volatile organic contamination of soils in the vicinity of BH6-87.

Well 2-87

The first of the four analyses presented in Appendix A to this memorandum reports 6 micrograms per liter (ug/l) 1,1-dichloroethene, 35 ug/l methylene chloride and 65 ug/l acetone. Both methylene chloride and acetone were found in the associated blank. Later analyses did not detect any of these compounds.

Based on this information, it is my opinion that there are not volatile organics in the ground water in the vicinity of well

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Table 3. Volatile and Semi-Volatile Compounds in Solid
Samples from BH6-87

<u>Sample</u>	<u>Depth (ft)</u>	<u>MCl</u>	<u>Ace</u>	<u>Bis</u>
BH06870010	0.0-10.0	NR	NR	1500 B
BH06871020	10.0-20.0	42	190 B	1100 B
BH068726CT	24.1-25.5	83	110 B	510 B

Claystone bedrock @ 25.5 feet

BH068730BR	27.0-30.0	23 J	180 B	1200 B
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Notes:

Units are micrograms per kilogram.

Compound abbreviations are as follows.

MCl = Methylene Chloride

Ace = Acetone

Bis = bis(2-Ethylhexyl)Phthalate

NR = Not reported in RI.

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2-87BR and that the detections in the first analysis result from laboratory or field procedures.

Well 3-87BR

There are five analyses of samples from 3-87BR presented in Appendix A. Three of these were for all of the Hazardous Substances List (HSL) volatiles and the first analysis found methylene chloride and toluene at estimated concentrations of 2 ug/l. These were not confirmed in the later analyses.

The first and second analyses also found acetone at 33 ug/l and at an estimated 3 ug/l; however, acetone was also found in the blanks for both samples. Although the RI does not present blank analyses, the estimated 3 ug/l is clearly an interference from lab contamination because the detection in the blank must have been at least equal to the detection limit (5 ug/l). The 33 ug/l is also probably the result of laboratory contamination and, under strict contract laboratory protocol, should have been reported as not detected, according to EPA (1985). Acetone was not found in the third analysis.

Based on this information, it is my opinion that there are not volatile organics in the ground water in the vicinity of well 3-87BR.

THREE WELL CLUSTER

Soil gas data did not indicate any reason for concern with regard organic contamination in the vicinity of the three well cluster. Nonetheless, three wells were drilled into the colluvium, the shallowest bedrock, and a deeper lignite horizon at a location thought likely to be contaminated (if contamination existed). Based on the detailed evaluations of the organic data presented below, it is concluded that organic contamination is not indicated in the vicinity of the three well cluster.

Well 8-87BR

The two samples from 8-87BR that were analyzed for all of the HSL volatiles contained methylene chloride at estimated concentrations of 2 and 4 ug/l. The analysis of the first sample also found toluene at an estimated concentration of 1 ug/l, 1,1-DCE at an estimate concentration of 2 ug/l and acetone at 11 ug/l (acetone was also found in the blank).

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Methylene chloride and acetone are the common laboratory contaminants and the detection of these compounds at such low concentrations does not mean that they are present in the ground water. Although 1,1-DCE was found in the first sample, it has not been found in four later analyses; it is concluded that the 1,1-DCE detection in the first sample is not environmentally significant.

Based on this information, it is concluded that there are not volatile organics in the ground water in the vicinity of well 8-87BR.

Well 59-86BR

Six analyses of samples from 59-86 are presented in Appendix A. Of these, only one analysis found a volatile compound. The single sample analyzed from 59-86 for all of the HSL volatiles contained acetone at an estimated concentration of 2 ug/l and acetone was also detected in the blank. Acetone should have been reported as not detected; it clearly is not present in the sample.

Well 69-86

Seven analyses of samples from 69-86 are presented in Appendix A. Only one of these found a volatile compound. The detected compound was acetone is one of the first samples at an estimated concentration of 2 ug/l. Acetone was also found in the associated blank. Note that the sample was duplicated and the duplicate analysis did not detect acetone. It is concluded that there are not volatile organics in the ground water in the vicinity of well 69-86.

WELLS BELOW SWMU 119.1

Wells 47-87 and 48-87 are colluvial wells located downgradient of the drain below SWMU 119.1. Well 47-87 has been sampled once (well was dry on February 15, 1988) and well 48-87 has been sampled twice. Volatile organic data for these wells are presented in Appendix A. Duplicate samples in November 1987 from both wells that appear in Appendix A are matrix spikes rather than split samples.

The common laboratory contaminants were detected in the first 48-87 sample at estimated concentrations and in the associated blank (methylene chloride at 2 ug/l and acetone at 4 ug/l). Otherwise, volatile organics are not detectable in the samples

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from wells 47-87 and 48-87. It is concluded that the detections of the common lab contaminants in the first sample from 48-87 are not environmentally significant.

CONCLUSIONS

The major conclusion of this review is that volatile and semi-volatile compounds are not present at environmentally significant concentrations downgradient of the proposed drain. However, in arriving at this conclusion, one must be convinced by the arguments presented here with regard to laboratory and field contamination of the solid samples (the lack of volatiles in the ground-water samples is easily demonstrable from the data alone). The laboratory and field contamination arguments are as follows.

- BH2-87. The detected compounds were not found in all the blanks, although the detected compounds are common laboratory contaminants. However, it is convincingly argued that the detections are not environmentally significant based on the nearly duplicate samples from about 12 to 14 feet below ground.
- BH3-87. The detected compounds are the common lab contaminants and they were at estimated concentrations or were also found in the associated blanks -- except for 2-butanone. Based on the detections of 2-butanone at the base of the alluvium and in the uppermost bedrock (remembering that 2-butanone is very soluble and is lighter than water in any event), it is concluded that the 2-butanone detections are unreasonable and that they, therefore, do not have environmental significance.
- BH6-87. Methylene chloride was detected in the samples but not in the associated blanks. It is argued that laboratory contamination by methylene chloride is likely because the concentrations are low. Acetone was found in the samples at more than ten-times a conservative estimate of the concentrations found in the blanks. It is argued that laboratory contamination is likely although it cannot be proved. I recommend that the actual blank values be obtained to further evaluate the acetone detections.

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REFERENCES

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Appendix A
VOLATILE ORGANIC DATA
SELECTED WELLS

Groundwater Volatile Organic Results for Selected 881 Hillside Wells at Rockwell (Rocky Flats)

Well Number	Field Sample Number	Date Sampled	Units	Chloro methane	Bromo methane	Vinyl Chloride	Chloro ethane	Methylene Chloride	Acetone	Carbon Disulfide	1,1-Dichloro ethane	1,1-Dichloro ethane	Trans-1,2-Dichloro ethane
881 HILLSIDE PARTIAL REPORT													
0287	2-87-05-29-87	05/29/87	2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
0287	642878403	06/24/87		10 U	10 U	10 U	10 U	35 B	65 B	5 U	5 U	5 U	5 U
0287	2-87-07-09-87	07/09/87	3	MR	MR	MR	MR	MR	MR	MR	MR	MR	4 U
0287	2-87-10-07-87	10/07/87	4	MR	MR	MR	MR	MR	MR	MR	MR	MR	5 U
0287	2-87-10-08-87	10/08/87		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
0287	02-87-02-10-88	02/10/88	1	10 U	10 U	10 U	10 U	5 U	10 U	5 U	5 U	5 U	5 U
0387	640387	06/16/87	2	10 U	10 U	10 U	10 U	2 J	33 B	5 U	5 U	5 U	5 U
0387	3-87-06-16-87	06/16/87	2	MR	MR	MR	MR	MR	MR	MR	MR	MR	4 U
0387	3-87-07-09-87	07/09/87	3	MR	MR	MR	MR	MR	MR	MR	MR	MR	4 U
0387	3-87-10-05-87	10/05/87	4	MR	MR	MR	MR	MR	MR	MR	MR	MR	5 U
0387	3-87-10-05-87	10/05/87		10 U	10 U	10 U	10 U	5 U	3 JB	5 U	5 U	5 U	5 U
0387	03-87-02-22-88	02/22/88	1	10 U	10 U	10 U	10 U	4 J	10 U	5 U	5 U	5 U	5 U
0887	640887	06/13/87		10 U	10 U	10 U	10 U	2 J	11 B	5 U	5 U	5 U	5 U
0887	8-87-06-15-87	06/15/87	2	MR	MR	MR	MR	MR	MR	MR	MR	MR	4 U
0887	8-87-07-09-87	07/09/87	3	MR	MR	MR	MR	MR	MR	MR	MR	MR	4 U
0887	8-87-10-07-87	10/07/87	4	MR	MR	MR	MR	MR	MR	MR	MR	MR	5 U
0887	08-87-02-22-88	02/22/88	1	10 U	10 U	10 U	10 U	4 J	10 U	5 U	5 U	5 U	5 U
5986	6598610860	10/08/86		10 U	10 U	10 U	10 U	5 U	2 BJ	5 U	5 U	5 U	5 U
5986	59-86-04-09-87	04/09/87	1	MR	MR	MR	MR	MR	MR	MR	MR	MR	4 U
5986	59-86-04-30-87	04/30/87	1	MR	MR	MR	MR	MR	MR	MR	MR	MR	4 U
5986	59-86-05-26-87	05/26/87	2	MR	MR	MR	MR	MR	MR	MR	MR	MR	4 U
5986	59-86-05-26-87	05/26/87	2	MR	MR	MR	MR	MR	MR	MR	MR	MR	4 U
5986	59-86-07-06-87	07/06/87	3	MR	MR	MR	MR	MR	MR	MR	MR	MR	4 U
5986	59-86-10-07-87	10/07/87	4	MR	MR	MR	MR	MR	MR	MR	MR	MR	5 U
5986	59-86-10-08-87	10/08/87		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5986	59-86-02-15-88	02/15/88	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6986	6498610860	10/08/86		10 U	10 U	10 U	10 U	5 U	2 BJ	5 U	5 U	5 U	5 U
6986	6498610862	10/08/86		10 U	10 U	10 U	10 U	5 U	10 U	5 U	5 U	5 U	5 U
6986	69-86-04-29-87	04/29/87	1	MR	MR	MR	MR	MR	MR	MR	MR	MR	4 U
6986	69-86-05-26-87	05/26/87	2	MR	MR	MR	MR	MR	MR	MR	MR	MR	4 U
6986	69-86-07-06-87	07/06/87	3	MR	MR	MR	MR	MR	MR	MR	MR	MR	4 U
6986	69-86-10-07-87	10/07/87	4	MR	MR	MR	MR	MR	MR	MR	MR	MR	5 U
6986	69-86-10-08-87	10/08/87		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6986	69-86-02-10-88	02/10/88	1	10 U	10 U	10 U	10 U	5 U	10 U	5 U	5 U	5 U	5 U
4787	47-87-11-30-87	11/30/87	4	10 U	10 U	10 U	10 U	5 U	10 U	5 U	5 U	5 U	5 U
4787	47-87-02-15-88	02/15/88	1	MR	MR	MR	MR	MR	MR	MR	MR	MR	MR
4887	48-87-11-18-87	11/18/87		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4887	48-87-11-18-87	11/18/87	4	10 U	10 U	10 U	10 U	2 JB	4 JB	5 U	5 U	5 U	5 U
4887	48-87-11-18-87	11/18/87		10 U	10 U	10 U	10 U	5 U	10 U	5 U	5 U	5 U	5 U
4887	48-87-02-15-88	02/15/88	1	10 U	10 U	10 U	10 U	5 U	10 U	5 U	5 U	5 U	5 U
5587	55-87-11-30-87	11/30/87	4	10 U	10 U	10 U	10 U	5 U	10 U	5 U	5 U	5 U	5 U
5587	55-87-11-30-87	11/30/87		MR	MR	MR	MR	MR	MR	MR	MR	MR	MR
5587	55-87-02-15-88	02/15/88	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes: MR = Analyte not reported
NA = Insufficient water in well for analysis
U = Analyzed but not detected
J = Present below detection limit
B = Present in laboratory blank

Groundwater Volatile Organic Results for
Selected 881 Hillside Wells at Rockwell (Rocky Flats)

Well Number	Field Sample Number	Date Sampled	Qtr.	Units	Chloroform	1,2-Dichloro ethane	2-Butanone	1,1,1-Trichloro ethane	Carbon Tetra chloride	Vinyl Acetate	Bromo dichloro methane	1,2-Dichloro propane	Trans-1,3-Dichloro propene	Trichloro ethane
881 HILLSIDE PARTIAL REPORT														
0287	2-87-05-29-87	05/29/87	2		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
0287	GW287H03	06/24/87		ug/kg	5 U	5 U	10 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U
0287	2-87-07-09-87	07/09/87	3	ug/l	4 U	4 U	NR	4 U	4 U	NR	NR	NR	NR	4 U
0287	2-87-10-07-87	10/07/87	4	ug/l	5 U	5 U	NR	5 U	5 U	NR	NR	NR	NR	5 U
0287	2-87-10-08-87	10/08/87			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
0287	02-87-02-10-88	02/10/88	1	ug/l	5 U	5 U	10 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U
0387	GW0387	06/16/87	2	ug/l	5 U	5 U	10 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U
0387	3-87-06-16-87	06/16/87	2	ug/l	4 U	4 U	NR	4 U	4 U	NR	NR	NR	NR	4 U
0387	3-87-07-09-87	07/09/87	3	ug/l	4 U	4 U	NR	4 U	4 U	NR	NR	NR	NR	4 U
0387	3-87-10-05-87	10/05/87	4	ug/l	5 U	5 U	NR	5 U	5 U	NR	NR	NR	NR	5 U
0387	3-87-10-05-87	10/05/87			5 U	5 U	10 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U
0387	03-87-02-22-88	02/22/88	1	ug/l	5 U	5 U	10 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U
0887	GW0887	06/13/87		ug/l	5 U	5 U	10 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U
0887	8-87-06-15-87	06/15/87	2	ug/l	4 U	4 U	NR	4 U	4 U	NR	NR	NR	NR	4 U
0887	8-87-07-09-87	07/09/87	3	ug/l	4 U	4 U	NR	4 U	4 U	NR	NR	NR	NR	4 U
0887	8-87-10-07-87	10/07/87	4	ug/l	5 U	5 U	NR	5 U	5 U	NR	NR	NR	NR	5 U
0887	08-87-02-22-88	02/22/88	1	ug/l	5 U	5 U	10 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U
5986	6598610860	10/08/86		ug/l	5 U	5 U	10 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U
5986	59-86-04-09-87	04/09/87	1	ug/l	4 U	4 U	NR	4 U	4 U	NR	NR	NR	NR	4 U
5986	59-86-04-30-87	04/30/87	1	ug/l	4 U	4 U	NR	4 U	4 U	NR	NR	NR	NR	4 U
5986	69-86-05-26-87	05/26/87	2	ug/l	4 U	4 U	NR	4 U	4 U	NR	NR	NR	NR	4 U
5986	59-86-05-26-87	05/26/87	2	ug/l	4 U	4 U	NR	4 U	4 U	NR	NR	NR	NR	4 U
5986	59-86-07-06-87	07/06/87	3	ug/l	4 U	4 U	NR	4 U	4 U	NR	NR	NR	NR	4 U
5986	59-86-10-07-87	10/07/87	4	ppb	5 U	5 U	NR	5 U	5 U	NR	NR	NR	NR	5 U
5986	59-86-10-08-87	10/08/87			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5986	59-86-02-15-88	02/15/88	1		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6986	6698610860	10/08/86		ug/l	5 U	5 U	10 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U
6986	6698610862	10/08/86		ug/l	5 U	5 U	10 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U
6986	69-86-04-29-87	04/29/87	1	ug/l	4 U	4 U	NR	4 U	4 U	NR	NR	NR	NR	4 U
6986	69-86-05-26-87	05/26/87	2	ug/l	4 U	4 U	NR	4 U	4 U	NR	NR	NR	NR	4 U
6986	69-86-07-06-87	07/06/87	3	ug/l	4 U	4 U	NR	4 U	4 U	NR	NR	NR	NR	4 U
6986	69-86-10-07-87	10/07/87	4	ppb	5 U	5 U	NR	5 U	5 U	NR	NR	NR	NR	5 U
6986	69-86-10-08-87	10/08/87			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6986	69-86-02-10-88	02/10/88	1	ug/l	5 U	5 U	10 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U
4787	47-87-11-30-87	11/30/87	4	ug/l	5 U	5 U	10 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U
4787	47-87-11-30-87	11/30/87			NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
4787	47-87-02-15-88	02/15/88	1		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4887	48-87-11-18-87	11/18/87		ug/l	5 U	5 U	10 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U
4887	48-87-11-18-87	11/18/87	4	ug/l	5 U	5 U	10 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U
4887	48-87-02-15-88	02/15/88	1	ug/l	5 U	5 U	10 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U
5587	55-87-11-30-87	11/30/87	4	ug/l	5 U	5 U	10 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U
5587	55-87-11-30-87	11/30/87			NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
5587	55-87-02-15-88	02/15/88	1		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes: NR = Analyte not reported
U = Analyzed but not detected
NA = Insufficient water in well for analysis
8 = Present in laboratory blank

Groundwater Volatile Organic Results for Selected 881 Hillside Wells at Rockwell (Rocky Flats)

Well Number	Field Sample Number	Date Sampled	Qtr.	Units	Dibromo chloro methane	1,1,2-Trichloro ethane	Benzene	cis-1,3-Dichloro propene	2-Chloro ethylvinyl ether	Bromoform	4-Methyl-2-pentanone	2-Hexanone	Tetrachloro ethene	1,1,2,2-Tetrachloro ethane
881 HILLSIDE PARTIAL REPORT														
0287	2-87-05-29-87	05/29/87	2	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
0287	642878403	06/24/87			5 U	5 U	5 U	5 U	10 U	5 U	10 U	10 U	5 U	5 U
0287	2-87-07-09-87	07/09/87	3	ug/l	NR	NR	NR	NR	NR	NR	NR	NR	4 U	NR
0287	2-87-10-07-87	10/07/87	4	ug/l	NR	NR	NR	NR	NR	NR	NR	NR	5 U	NR
0287	2-87-10-08-87	10/08/87			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
0287	02-87-02-10-88	02/10/88	1	ug/l	5 U	5 U	5 U	5 U	10 U	5 U	10 U	10 U	5 U	5 U
0387	640387	06/16/87	2	ug/l	5 U	5 U	5 U	5 U	10 U	5 U	10 U	10 U	5 U	5 U
0387	3-87-06-16-87	06/16/87	2	ug/l	NR	NR	NR	NR	NR	NR	NR	NR	4 U	NR
0387	3-87-07-09-87	07/09/87	3	ug/l	NR	NR	NR	NR	NR	NR	NR	NR	5 U	NR
0387	3-87-10-05-87	10/05/87	4	ug/l	NR	NR	NR	NR	NR	NR	NR	NR	5 U	NR
0387	3-87-10-05-87	10/05/87			5 U	5 U	5 U	5 U	10 U	5 U	10 U	10 U	5 U	5 U
0387	03-87-02-22-88	02/22/88	1	ug/l	5 U	5 U	5 U	5 U	10 U	5 U	10 U	10 U	5 U	5 U
0887	640887	06/13/87			5 U	5 U	5 U	5 U	10 U	5 U	10 U	10 U	5 U	5 U
0887	8-87-06-15-87	06/15/87	2	ug/l	NR	NR	NR	NR	NR	NR	NR	NR	4 U	NR
0887	8-87-07-09-87	07/09/87	3	ug/l	NR	NR	NR	NR	NR	NR	NR	NR	5 U	NR
0887	8-87-10-07-87	10/07/87	4	ug/l	NR	NR	NR	NR	NR	NR	NR	NR	5 U	NR
0887	08-87-02-22-88	02/22/88	1	ug/l	5 U	5 U	5 U	5 U	10 U	5 U	10 U	10 U	5 U	5 U
5986	6598610860	10/08/86			5 U	5 U	5 U	5 U	10 U	5 U	10 U	10 U	5 U	5 U
5986	59-86-04-09-87	04/09/87	1	ug/l	NR	NR	NR	NR	NR	NR	NR	NR	4 U	NR
5986	59-86-04-30-87	04/30/87	1	ug/l	NR	NR	NR	NR	NR	NR	NR	NR	4 U	NR
5986	59-86-05-26-87	05/26/87	2	ug/l	NR	NR	NR	NR	NR	NR	NR	NR	6	NR
5986	59-86-05-26-87	05/26/87	2	ug/l	NR	NR	NR	NR	NR	NR	NR	NR	6	NR
5986	59-86-07-06-87	07/06/87	3	ug/l	NR	NR	NR	NR	NR	NR	NR	NR	4 U	NR
5986	59-86-10-07-87	10/07/87	4	ppb	NR	NR	NR	NR	NR	NR	NR	NR	5 U	NR
5986	59-86-10-08-87	10/08/87			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5986	59-86-02-15-88	02/15/88	1		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6986	6698610860	10/08/86			5 U	5 U	5 U	5 U	10 U	5 U	10 U	10 U	5 U	5 U
6986	6698610862	10/08/86			5 U	5 U	5 U	5 U	10 U	5 U	10 U	10 U	5 U	5 U
6986	69-86-04-29-87	04/29/87	1	ug/l	NR	NR	NR	NR	NR	NR	NR	NR	4 U	NR
6986	69-86-05-26-87	05/26/87	2	ug/l	NR	NR	NR	NR	NR	NR	NR	NR	4 U	NR
6986	69-86-07-06-87	07/06/87	3	ug/l	NR	NR	NR	NR	NR	NR	NR	NR	4 U	NR
6986	69-86-10-07-87	10/07/87	4	ppb	NR	NR	NR	NR	NR	NR	NR	NR	5 U	NR
6986	69-86-10-08-87	10/08/87			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6986	69-86-02-10-88	02/10/88	1	ug/l	5 U	5 U	5 U	5 U	10 U	5 U	10 U	10 U	5 U	5 U
4787	47-87-11-30-87	11/30/87	4	ug/l	5 U	5 U	5 U	5 U	10 U	5 U	10 U	10 U	5 U	5 U
4787	47-87-11-30-87	11/30/87			NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
4787	47-87-02-15-88	02/15/88	1		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4887	48-87-11-18-87	11/18/87			5 U	5 U	5 U	5 U	10 U	5 U	10 U	10 U	5 U	5 U
4887	48-87-11-18-87	11/18/87	4	ug/l	5 U	5 U	5 U	5 U	10 U	5 U	10 U	10 U	5 U	5 U
4887	48-87-02-15-88	02/15/88	1	ug/l	5 U	5 U	5 U	5 U	10 U	5 U	10 U	10 U	5 U	5 U
5587	55-87-11-30-87	11/30/87	4	ug/l	5 U	5 U	5 U	5 U	10 U	5 U	10 U	10 U	5 U	5 U
5587	55-87-11-30-87	11/30/87			NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
5587	55-87-02-15-88	02/15/88	1		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes: NR = Analyte not reported
NA = Insufficient water in well for analysis
U = Analyzed but not detected
J = Present below detection limit
8 = Present in laboratory blank

Groundwater Volatile Organic Results for
Selected 881 Hillside Wells at Rockwell (Rocky Flats)

Well Number	Field Sample Number	Date Sampled	Qtr.	Units	Toluene	Chloro benzene	Ethyl benzene	Styrene	Total Xylenes
881 HILLSIDE PARTIAL REPORT									
0287	2-87-05-29-87	05/29/87	2		NA	NA	NA	NA	NA
0287	GM287BHO3	06/24/87		ug/kg	5 U	5 U	5 U	5 U	5 U
0287	2-87-07-09-87	07/09/87	3	ug/l	NR	NR	NR	NR	NR
0287	2-87-10-07-87	10/07/87	4	ug/l	NR	NR	NR	NR	NR
0287	2-87-10-08-87	10/08/87			NA	NA	NA	NA	NA
0287	02-87-02-10-88	02/10/88	1	ug/l	5 U	5 U	5 U	5 U	5 U
0387	GM0387	06/16/87	2	ug/l	2 J	5 U	5 U	5 U	5 U
0387	3-87-06-16-87	06/16/87	2	ug/l	NR	NR	NR	NR	NR
0387	3-87-07-09-87	07/09/87	3	ug/l	NR	NR	NR	NR	NR
0387	3-87-10-05-87	10/05/87	4	ug/l	NR	NR	NR	NR	NR
0387	3-87-10-05-87	10/05/87			5 U	5 U	5 U	5 U	5 U
0387	03-87-02-22-88	02/22/88	1	ug/l	5 U	5 U	5 U	5 U	5 U
0887	GM0887	06/13/87		ug/l	1 J	5 U	5 U	5 U	5 U
0887	8-87-06-15-87	06/15/87	2	ug/l	NR	NR	NR	NR	NR
0887	8-87-07-09-87	07/09/87	3	ug/l	NR	NR	NR	NR	NR
0887	8-87-10-07-87	10/07/87	4	ug/l	NR	NR	NR	NR	NR
0887	08-87-02-22-88	02/22/88	1	ug/l	5 U	5 U	5 U	5 U	5 U
5986	6598610860	10/08/86			5 U	5 U	5 U	5 U	5 U
5986	59-86-04-09-87	04/09/87	1	ug/l	NR	NR	NR	NR	NR
5986	59-86-04-30-87	04/30/87	1	ug/l	NR	NR	NR	NR	NR
5986	59-86-05-26-87	05/26/87	2	ug/l	NR	NR	NR	NR	NR
5986	59-86-05-26-87	05/26/87	2	ug/l	NR	NR	NR	NR	NR
5986	59-86-07-06-87	07/06/87	3	ug/l	NR	NR	NR	NR	NR
5986	59-86-10-07-87	10/07/87	4	ppb	NR	NR	NR	NR	NR
5986	59-86-10-08-87	10/08/87			NA	NA	NA	NA	NA
5986	59-86-02-15-88	02/15/88	1		NA	NA	NA	NA	NA
6986	6698610860	10/08/86		ug/l	5 U	5 U	5 U	5 U	5 U
6986	6698610862	10/08/86		ug/l	5 U	5 U	5 U	5 U	5 U
6986	69-86-04-29-87	04/29/87	1	ug/l	NR	NR	NR	NR	NR
6986	69-86-05-26-87	05/26/87	2	ug/l	NR	NR	NR	NR	NR
6986	69-86-07-06-87	07/06/87	3	ug/l	NR	NR	NR	NR	NR
6986	69-86-10-07-87	10/07/87	4	ppb	NR	NR	NR	NR	NR
6986	69-86-10-08-87	10/08/87			NA	NA	NA	NA	NA
6986	69-86-02-10-88	02/10/88	1	ug/l	5 U	5 U	5 U	5 U	5 U
4787	47-87-11-30-87	11/30/87	4	ug/l	5 U	5 U	5 U	5 U	5 U
4787	47-87-11-30-87	11/30/87			NR	NR	NR	NR	NR
4787	47-87-02-15-88	02/15/88	1	ug/l	NA	NA	NA	NA	NA
4887	48-87-11-18-87	11/18/87		ug/l	5 U	5 U	5 U	5 U	5 U
4887	48-87-11-18-87	11/18/87	4	ug/l	5 U	5 U	5 U	5 U	5 U
4887	48-87-02-15-88	02/15/88	1	ug/l	5 U	5 U	5 U	5 U	5 U
5587	55-87-11-30-87	11/30/87	4	ug/l	5 U	5 U	5 U	5 U	5 U
5587	55-87-11-30-87	11/30/87			NR	NR	NR	NR	NR
5587	55-87-02-15-88	02/15/88	1		NA	NA	NA	NA	NA

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